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(54) **Multi-position electric switch**

(57) A multi-position lever switch, has a detent means (18; 22) for retaining an operating member 10, 12 in any one of a number of positions, and which can be positioned in each of two locations 32, 34 so as to vary the positions of the operating member 10. The operating member 10 can have an odd or even number of positions corresponding to recess 24 cooperating with detent 22, and symmetrically disposed about a common centre line 30.

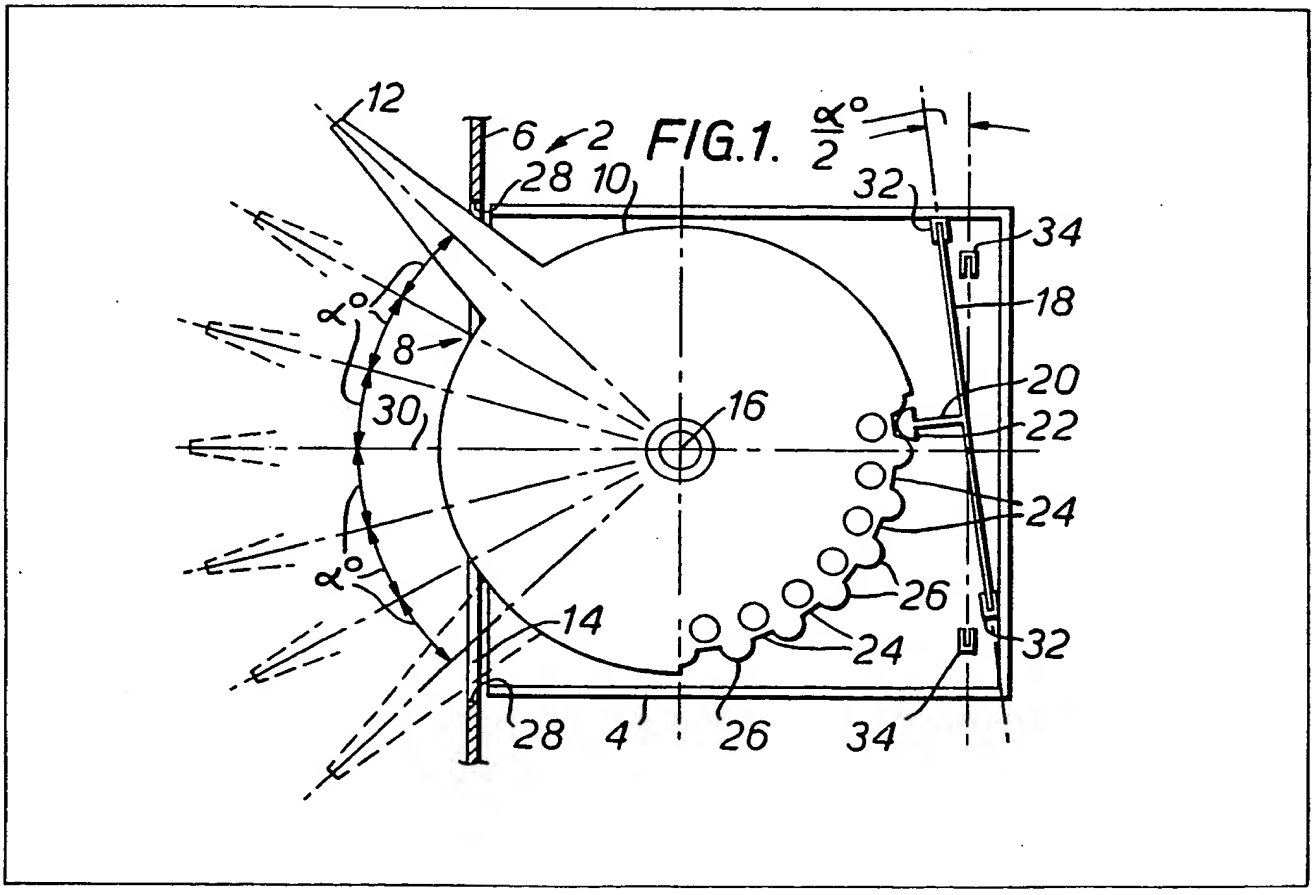

FIG.1.

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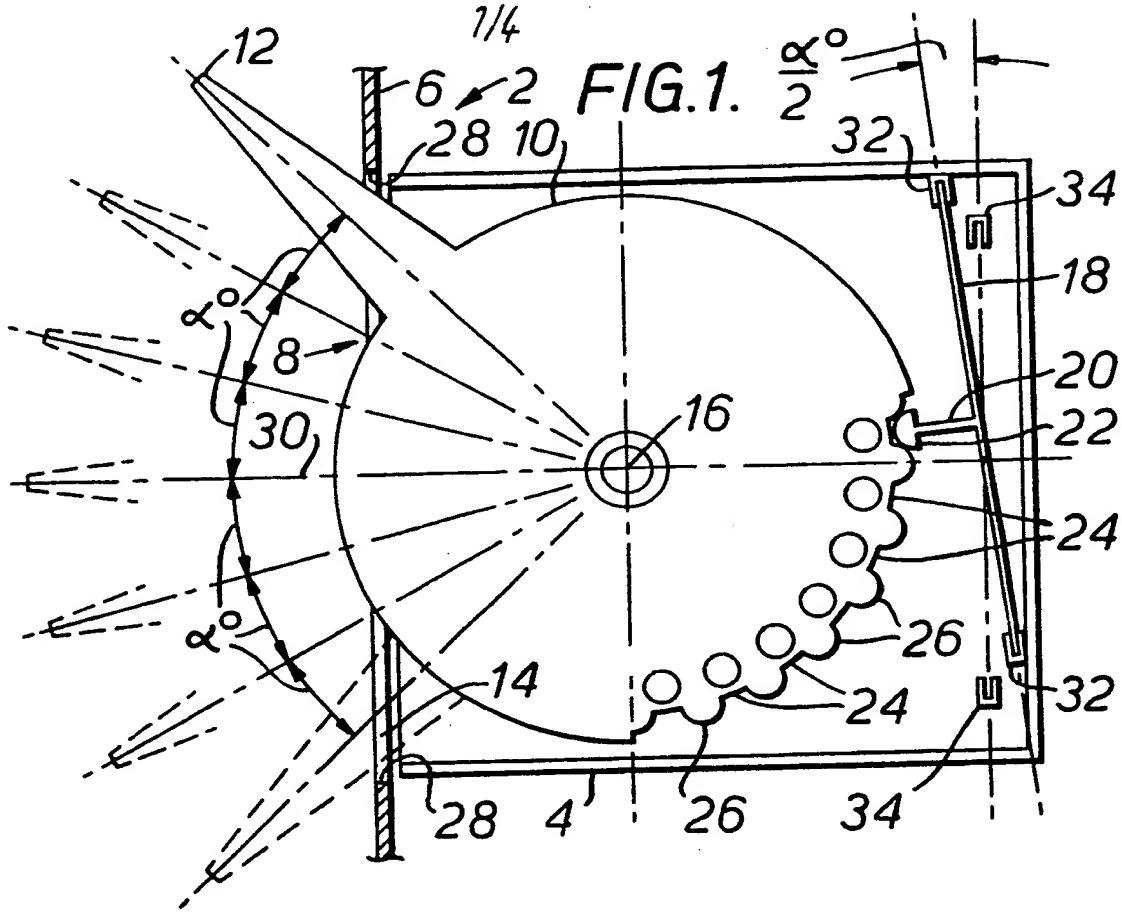


FIG.2.

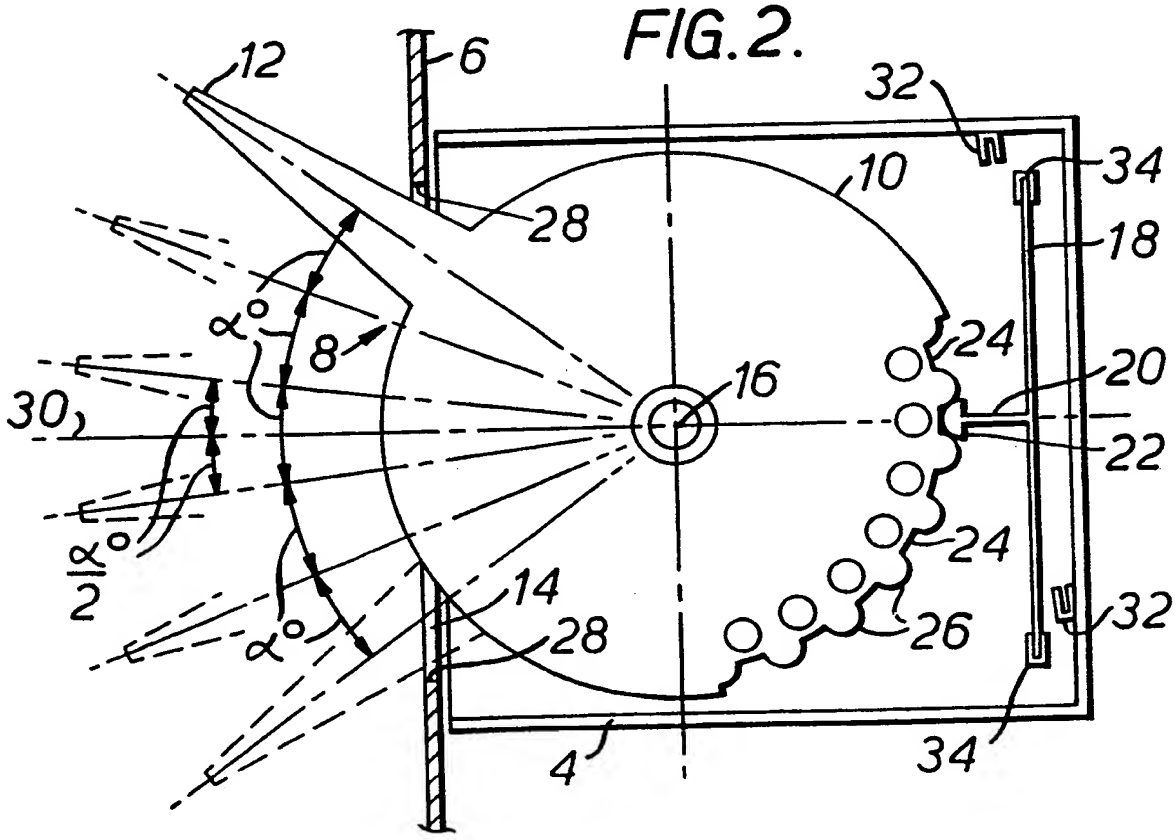


FIG.3.

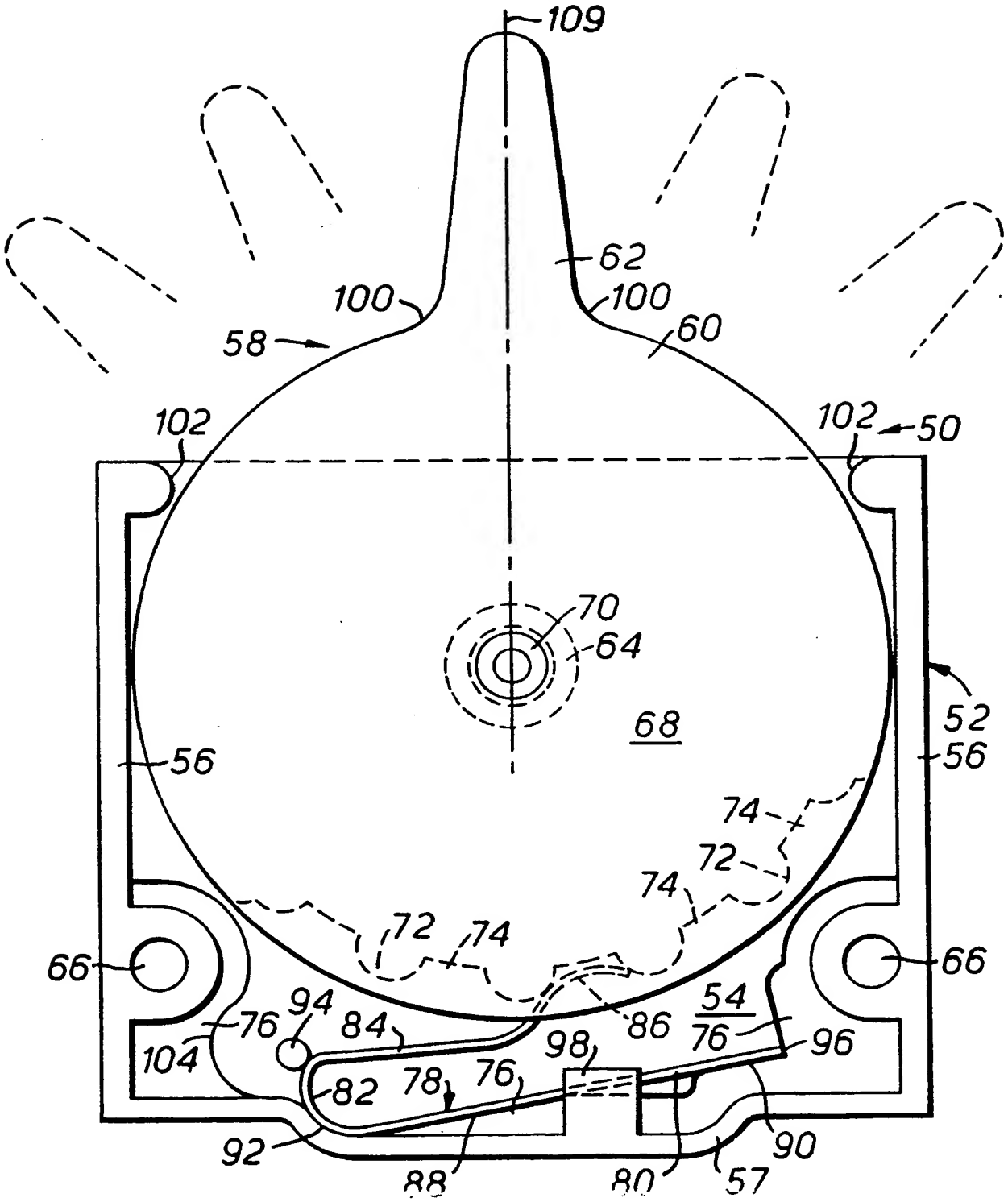


FIG. 4.

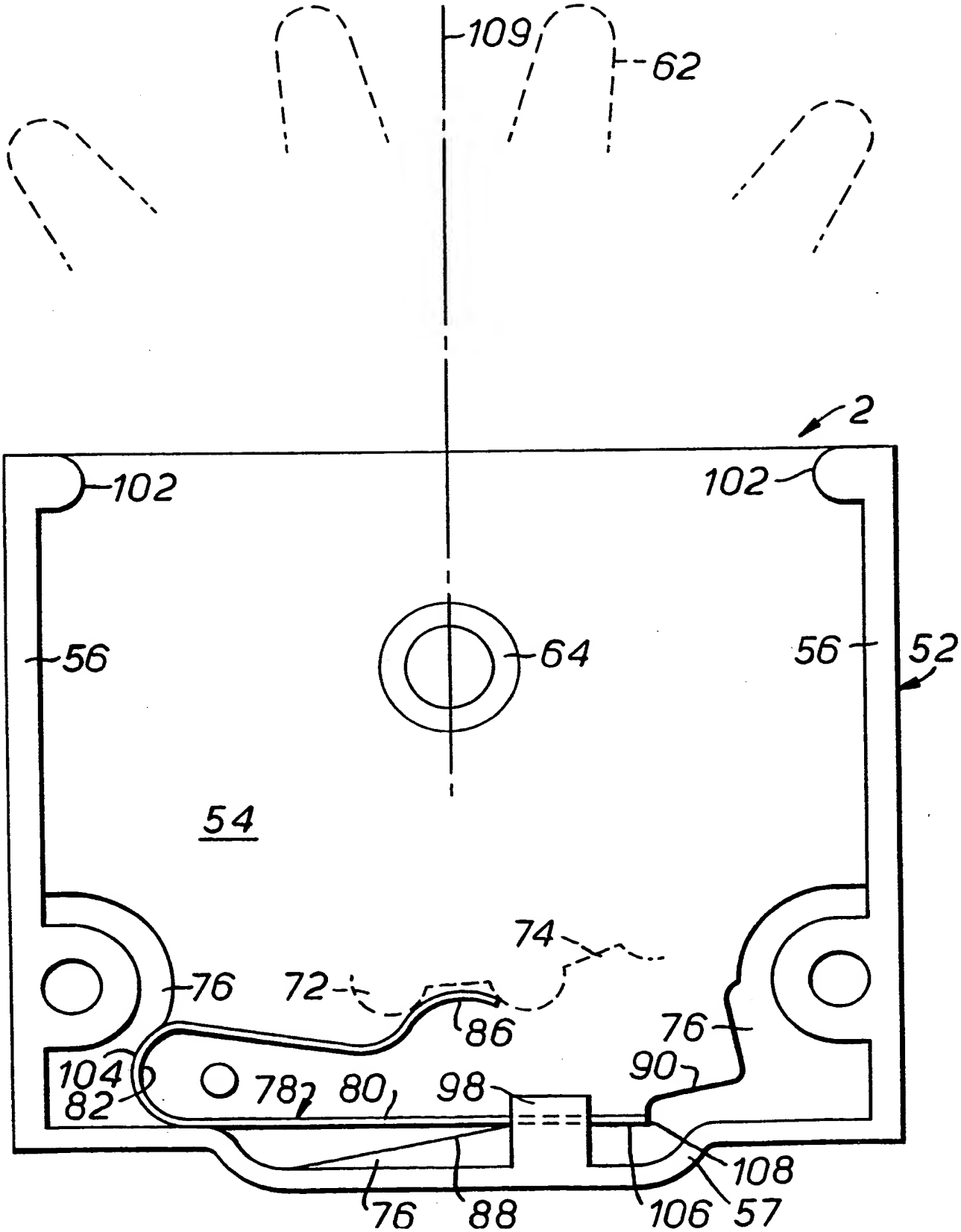
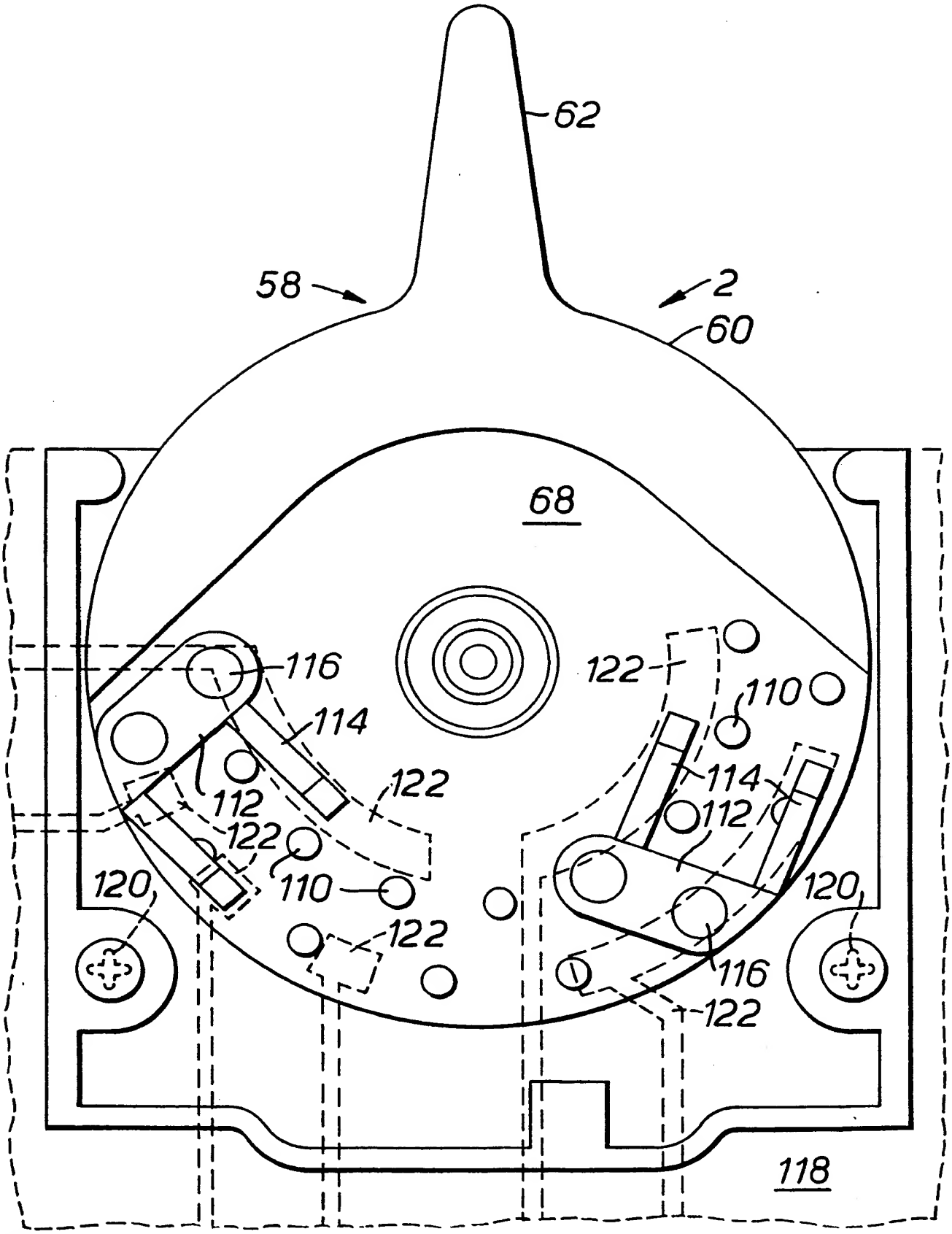


FIG. 5.



SPECIFICATION

Multi-position switch

This invention relates to a multi-position switch, and particularly to a switch of the type having a member which is rotated to operate the switch, a detent being provided to retain the member in any selected one of a number of positions spaced around the axis of rotation of the member.

It is desirable to provide a switch which is versatile enough to be used in various situations, and can meet the varying requirements of the circuitry with which it is to be used and the instrument casings in which it is to be installed.

In accordance with the invention there is provided a multi-position switch having a detent means which can be positioned in each of two locations, in one of which the detent means is operable to cause a rotatable switch operating member to be retained in any one of a first set of positions around its axis of rotation, and in the other of which the member can be retained in any one of a second set of positions at least some of which are intermediate respective pairs of the positions of said first set.

The invention is particularly advantageous in the field of lever switches. A lever switch has a rotatable operating member, and a lever extending radially away from the axis of rotation and fixed to or integrally formed with the member. The lever projects outwardly of the instrument casing in which the switch is mounted, and is moved linearly (e.g. vertically or horizontally) to rotate the member and operate the switch.

To use the switch with different circuits, it is necessary that the number of positions of the operating member be variable. This can be achieved by providing stops to limit the amount of movement of the operating member around its axis, the positions of the stops thereby defining the maximum number of positions of the operating member.

However, a lever switch in accordance with the invention can be arranged so that the number of the positions in the first set which are located between the limits of movement of the operating member differs from the number of positions in the second set. This means that, for a given position of the stops, the number of switch positions can be varied simply by altering the location of the detent means.

Furthermore, it is desirable from an aesthetic point of view and for ease of operation to have a symmetrical disposition of the various positions of the lever. For example, if the lever is arranged to be moved vertically to operate the switch, it is desirable that the lever positions be symmetrically disposed about a horizontal line extending outwardly from the instrument casing. This presents difficulties if the same switch is intended for use in circumstances in which it has an odd number of positions, as well as in situations requiring an even number of positions of the switch. For example, if the switch is arranged so that the lever positions are symmetrically disposed in the manner described above when there is an odd number of positions, restricting the movement of the switch so that there is an even number of positions will result in the latter being non-symmetrically disposed.

This problem can be overcome by using a lever switch in accordance with the invention. The stops are arranged so that there is an odd number of positions in the first set, and an even number in the second set, or vice versa. The switch can be arranged so that each position of the second set is disposed centrally between two positions of the first set. Thus, if the first set of positions is symmetrically disposed about a centre line, the second set of positions will also be symmetrically disposed.

The detent means can be a spring located in a switch housing, and engageable with recesses in the operating member. Alternatively, the spring can be disposed on the operating member, and the recesses in the housing.

Furthermore, instead of arranging the switch so that the spring can be positioned in each of two locations, it is possible to provide an arrangement whereby the locations of the recesses can be altered, the recesses in this case forming the above-mentioned detent means.

Arrangements embodying the invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a lever switch in accordance with the invention, with its detent means in a first location,

Figure 2 shows the switch of Figure 1 with the detent means in a second location,

Figure 3 is a plan view of a preferred embodiment of a lever switch in accordance with the invention, with its detent means in a first location,

Figure 4 shows the switch of Figure 3 with the detent means in a second location, and

Figure 5 is a plan view illustrating the contacts of the switch of Figure 3.

Referring to Figure 1, a switch 2 has a housing 4 mounted on the inside of an instrument casing 6. The switch has an operating member 8 in the form of a disc-like rotor 10 and an integrally formed lever 12 projecting radially outwardly from the rotor 10.

The lever 12 projects outwardly through a slot 14 in the instrument casing, and can be moved vertically to rotate the operating member about an axis 16 through the centre of the rotor 10.

The switch 2 is also provided with a detent means in the form of a spring plate 18 carrying an element 20 which projects towards the circumference of the rotor 10. The head 22 of the element 20 is engageable in recesses 24 formed between semi-circular projections 26 on the circumference of the rotor 10. Thus, as the lever 12 is moved vertically, the projections 26 push against the head 22 of the element 20 to bow the spring plate 18 until the head locates in a recess 24. This allows the lever to be moved to and retained in any one of the seven positions indicated in broken and solid lines in Figure 1. The positions of

the lever are separated from one another by an angle α around the axis 16. The amount of movement of the operating member 8, and consequently the maximum number of positions of the lever 12, is limited by the engagement of the lever with stops formed by the edges 28 of the slot 14.

It will be observed that the lever positions are symmetrically disposed about a central line 30 which extends horizontally outwardly from the vertical casing 6.

The spring plate 18 is mounted in a pair of slots 32. As indicated in Figure 2, the spring plate 18 can be removed from the slots and inserted into another pair of slots 34. In this position, the spring plate 18 is displaced from the position shown in Figure 1 by an angle of $\alpha/2$ around a horizontal axis normal to the plane of the drawings.

As shown in Figure 2, this results in the positions of the lever 12 being displaced by $\alpha/2$ about the axis 16 from the positions shown in Figure 1. Thus, each position of the lever 12 in Figure 2 is disposed centrally between two of the positions of the lever as indicated in Figure 1.

Furthermore, in the arrangement of Figure 2, a different sized slot 14 is used, the edges 28 of the slot 14 being arranged to restrict the movement of the lever so that it can take only six positions. Any attempt to push the lever upwardly to engage the head 22 of the element 20 in the upper recess 24 will cause the lever 12 to engage the upper edge 28 of the slot 14 before the head 22 locates in the upper recess.

The positions of the lever in the arrangement of Figure 2 are also symmetrically disposed about the horizontal line 30 extending outwardly from the casing 6.

The rotor 10 carries electrical contacts to effect various connections with the circuitry of the equipment, depending upon the position of the lever 12.

The switch 2 can be used in a variety of situations, and meets various requirements without needing additional parts. If the switch is to have an odd number of positions, the spring plate 18 is positioned as indicated in Figure 1, and if it is to have an even number of positions the plate 18 is located as indicated in Figure 2. In each case, the particular number of positions of the lever can be chosen by selecting the appropriate size of the aperture 14. In all cases, the various positions of the lever 12 can be disposed symmetrically about a common central horizontal line.

Referring to Figure 3, another embodiment of a lever switch in accordance with the invention is indicated at 50. The switch includes a housing 52 having a base 54, side walls 56 and a back wall 57.

The switch 50 also has an operating member 58, similar to the operating member 8 of Figures 1 and 2, and including a rotor 60 and an integrally formed lever 62 projecting from the front of the housing 52.

The base 54 of the housing 52 has a hollow cylindrical projection 64 extending upwardly therefrom, to receive a shaft (not shown) extending downwardly from the underside of the rotor 60, to rotatably mount the rotor in the housing 52.

As further described below, the switch 50 is designed for use with a printed circuit board, and the housing is fixed thereto by screws passing through holes 66, with the rotor 60 interposed between the base 54 of the housing 52 and the surface of the printed circuit board. The upper surface 68 of the rotor 60 is provided with contacts for engaging contacts printed on the printed circuit board. The rotor 60 has a central shaft 70 projecting upwardly to engage in a hole in the printed circuit board to support the rotor for rotation.

The rotor is provided with projections 72 and recesses 74, similar to the projections 26 and recesses 24 of the arrangement of Figures 1 and 2. The projections and recesses extend part-way around the circumference of the rotor 60, and underneath its upper surface 68.

The housing 52 is provided with ledges 76 about half-way up the walls 56 and 57. The walls of these ledges serve to locate a detent means in the form of a spring 78. The spring 78 has a straight portion 80 which locates against the walls of the ledges 76, and which is connected by a U-shaped portion 82 to a second, shorter straight portion 84. The portion 84 has a curved free end 86 arranged to locate in the recesses 74 of the rotor 60.

In the arrangement shown in Figure 3, the straight portion 80 of the spring 78 abuts a ramp formed by portions 88 and 90 of the walls of the ledges 76. The U-shaped portion 82 engages a curved portion 92 of the wall 57 of the housing 52, and also abuts a cylindrical peg 94 extending upwardly from the base 54 of the housing 52.

With this arrangement, the lever 62 can be moved to any one of the five symmetrically disposed positions indicated in solid and broken lines. Movement of the spring 78 is prevented by its engagement with the peg 94, the wall portion 92, and a further wall portion 69 located adjacent the end of the straight portion 80. Any upward movement of the spring 78 is restricted by an overhanging projection 98, and by the underside of the upper surface 68 of the rotor 60.

Movement of the outwardly projecting lever 62 is restricted by the engagement of corners 100 joining the lever to the rotor 60 with curved portions 102 at the ends of the side walls 56.

The spring 78 can be removed and replaced in the position indicated in Figure 4, wherein only part of the operating member 58 is shown in broken lines for clarity. This is most easily achieved if the rotor 60 is removable from the cylindrical projection 64.

In this position, the U-shaped portion 82 of the spring engages a correspondingly shaped portion 104 of the wall of a ledge 76. The straight portion 80 of the spring engages a wall portion 106. The free end 86 of the spring is therefore shifted with respect to the position shown in Figure 3, and this results in the lever 62 taking any one of the four positions indicated in broken lines. Movement of the spring 78 is prevented by its engagement with the wall portion 104, a wall portion 108 at the end of the straight portion 80, the overhanging projection 98, and the underside of the upper surface of the rotor.

The four positions of the lever 62 shown in Figure 4 are disposed intermediate the positions of the lever indicated in Figure 3. In each case the positions

of the lever are symmetrically disposed about a common centre line 109, and between the limits of the operating member's movement.

As an alternative arrangement to the one described above, the spring 78 has only a single location. The recesses 74 and projections 72 are formed in a member which is separate from but attachable to the rotor 60. This member can be fixed to the rotor at two separate locations spaced around the circumference of the rotor, so that the positions adopted by the lever 62 are changed when the locations of the member is altered.

Referring to Figure 5, the upper surface 68 of the rotor 60 is provided with a series of regularly spaced studs 110, for receiving and retaining contact members 112. Each contact member 112 has a pair of holes through which a pair of studs passes, and a pair of upwardly inclined contacts 114. After the contact is located on a pair of studs, the studs are pressed to expand their upper diameters as indicated at 116, so as to retain the contact members 112 in position.

A printed circuit board 118 (shown in broken lines for clarity) is positioned over the switch 2, the latter being fixed thereto by screws 120. The board 118 has contacts 122 printed on its underside for engaging the contacts 114. The pattern of the contacts 122 is arranged so that particular ones thereof are interconnected by the contact members 112 at certain positions of the operating member 58.

The number of contact members, their positions around the circumference of the rotor 60, and the pattern of the contacts 122 can be chosen to suit the particular requirements of the circuit to which the switch is connected. This arrangement, and the possibility of varying the maximum number of switch positions while keeping the latter symmetrical, produces an extremely versatile switch, which can be used in a variety of situations without requiring any interchange or addition of parts.

CLAIMS

1. A multi-position switch having a detent means which can be positioned in each of two locations, in one of which the detent means is operable to cause a rotatable switch operating member to be retained in any one of a first set of positions around its axis of rotation, and in the other of which the member can be retained in any one of a second set of positions at least some of which are intermediate respective pairs of the positions of said first set.

2. A switch as claimed in claim 1 wherein each of the positions of said second set is disposed centrally between two of the positions of the first set, whereby both sets of positions are symmetrical about a common centre line.

3. A switch as claimed in claim 2 including stops for limiting the amount of rotation of the operating member around its axis, wherein both sets of positions are symmetrically disposed between the limits of the operating member's movement.

4. A switch as claimed in any preceding claim wherein the detent means comprises a spring arranged to engage recesses to retain the operating member in its positions.

5. A switch as claimed in any one of claims 1 to 3 wherein the detent means comprises a number of recesses in which a spring is arranged to engage.

6. A switch as claimed in any preceding claim wherein the two locations of the detent means are positioned on a housing of the switch.

7. A switch as claimed in any preceding claim wherein the operating member has means for receiving electrical contacts in a plurality of positions spaced around its axis of rotation.

8. A switch as claimed in any preceding claim in the form of a lever switch, wherein the operating member comprises a rotor having an operating lever extending radially outwardly from the rotor.

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